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LINGUISTICS 221: CROSS-LINGUISTIC PHONETICS

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Objectives

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- Provide a toolbox for describing and analyzing the phonetic structures of the world's languages
- Identify 'core sounds' (up to slide 20) that are important in many languages; core sounds are reinforced through lots of practice (especially with English), the core is then extended to account for other languages
- Describe the phonetic mechanisms used in languages other than English

Prerequisites

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- Solid understanding of the basic anatomical structures involved in sound production
- Reading: first chapter of Ladefoged's *A course in phonetics*
- Exercise: review articulators
- Exercise: mid-sagittal profiles for consonants
- Task: review principal factors for vowels

Lectures to come

- Phonetic transcription
- English consonants
- English vowels
- Beyond English

Phonetic transcription

- Over-arching goal: give a unique symbolic representation for each distinct sound in a transcription system that is sufficient to the task at hand
- Uses of transcription
 - ▣ Make written records of understudied languages
 - ▣ Describe speech of individuals, e.g., with speech deficits
 - ▣ Record speech development over time
 - ▣ Make records that computers can refer to
 - ▣ Many more ...
- Limitation: phonetic transcription is less of a phonetic analysis and more of a means towards over ends ... there's much more to phonetics than transcription

Spelling is not enough

- Observation: while some spelling systems make good records of pronunciation, many are inadequate for the goals of transcription
- Problems with English
 - ▣ Single letter, many sounds: *cap*, *receive*
 - ▣ Single sound, many letters: *sip*, *receive*
 - ▣ Two letters, one sound: *phone* (cf. *foam*)
 - ▣ One letter, two sounds: *text*
- Goal: each distinct sound has a unique symbol

Different degrees of detailedness

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- Observation: different objectives require different degrees of detailedness, or amount of phonetic information.
- Phonemic transcription: uses only phonemes, the basic contrastive sounds of the language
 - Cf. 'broad transcription': transcription that uses the simplest possible set of symbols
- Systematic phonetic transcription: requires an understanding of all the allophones (i.e., different realizations of a phoneme) and uses exactly these allophones; transcription rarely uses all of this detail
 - Cf. 'narrow transcription': introduces more phonetic detail, including the sounds that result from allophonic rules

Detailedness, cont'd

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- Illustration: detailedness for *tapped*
 - Broad: [tæpt]
 - Narrow: [tʰæp̚t̚]
- Assumptions
 - [t] is a phoneme that has two allophones, aspirated [tʰ] word-initially, and [t] everywhere else.
 - [p] is a phoneme that has two allophones, unexploded [p̚] before another stop, and [p] elsewhere
- Upshot: the narrow description contains more phonetic detail and may be required in some analytical contexts, e.g., studying the phonetic properties of stops

To be continued ... phonemic analysis

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- Phonemic analysis of English consonants and vowels
- Methods for discovering phonemes and allophones
- Characterization of allophone rules

The symbols of consonants

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- Goal: each sound has a unique symbol (appropriate for level of detail needed)
- Exercise: with examples given for each symbol, characterize the sound using the five phonetic factors for consonants. Do this in a table.
 - Stops: p b, t d, k g
 - Fricatives: f v, θ ð, s z, ʃ (=ʒ) ʒ (=ʒ)
 - Affricates: tʃ (=tʃ) dʒ (=dʒ)
 - Nasals: m, n, ŋ
 - Approximants: l r w j h
- Note: the symbols in parentheses are given because they appear in some published reports; learn the non-parenthesized symbols.

Some new symbols to learn

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- Note: you don't need to know these names, but it's crucial to know the relationship between the symbol and the sound.
 - Theta: θ
 - Eth: ð
 - Esh: ʃ
 - Yogh: ʒ
 - Angma: ŋ

Some issues

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- Affricates: one or two sounds?
 - Phonetically: seem to be two sounds, because difference between e.g., *white shoes* and *why choose* is just a matter of timing.
 - Phonologically: seem to be one unit, because [tʃ] and [dʒ] are not like other consonants in C_ clusters; they only occur after [ɪ] and [ɔ], so easier to assume they are part of an atomic whole, called an affricate
 - Conclusion: we will write them with a two letter symbol, but in phonology we will analyze them as a single atomic unit.
- What about [h]?
 - Some phoneticians assume that [h] doesn't belong in the consonant inventory, because it is more vowel-like and simply takes on the phonetic properties of the surrounding sounds. We will assume, however, that [h] is a consonant, namely a glottal approximant. This is consistent with its phonemic status (it is a phoneme) and its 'placelessness' and vowel-like status.

Consonant symbols, cont'd

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- Exercise: now draw a two dimensional chart that illustrates the phonetic similarities and differences among the consonants. Your chart should represent Place as columns, Manner as rows, voicing as the order in which consonants appear in a cell, and the presence/absence of velic closure and airflow as distinct manner classes (i.e., different rows).

The importance of examples

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- Use charts of actual words to help you remember symbols, and relate new words to words that you know are correctly classified.
 - Illustration: *measure* (what is medial /s/?), cf. *vision* vs. *mission*, *mizzen*
- Resource: Ladefoged *A course in phonetics* has such a chart of examples for consonants.

The symbols of vowels

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- Exercise: in a table characterize each of the sounds below in terms of the three phonetic factors, and additionally in terms of the monothong/diphthong distinction.
- Definitions
 - Monophthong: a vowel where there is no appreciable change in vowel quality, e.g., [ɑ] in *father*.
 - Diphthong: a vowel where there there is a change from one vowel quality to another in a single syllable.

Vowel symbols, cont'd

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- Front vowels: i I ε æ
- Back vowels: u ʊ ɔ ɑ
- Central vowels: ʌ ɜr
 - ▣ Note: tongue advancement is not just a matter of front/back, the central vowels are intermediate in tongue advancement.

Vowel symbols, cont'd

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- Observation: many vowel qualities only occur as part of a diphthong, or before an [r] sound.
- Diphthongs with [ɪ]: eɪ aɪ ɔɪ
- Diphthongs with [ʊ]: aʊ oʊ
- 'Diphthongs' ending in [r]: ɪr ɛr aɪr
 - ▣ Note: Standard British pronunciation of words like *here*, *hair*, *hire* do not have the [r], but instead a central vowel [ə] 'schwa'

Vowel symbols, cont'd

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- **R-coloring:** in words like *per*, *bird*, the central vowel [ɜ] is sometimes said to be 'r-colored', i.e., have some of the properties of an [r]; we will instead simply transcribe it with an [r], thus: [pɜrt] and [bɜrd]; British pronunciation lacks this r-coloring
- **More on schwa:** a very important central mid vowel is [ə], which occurs in unstressed syllables in many English dialects. They are the last syllables in *sofa*, *soda*, so: [sɒfə], [sɒdə]. Unstressed vowels are a little difficult to transcribe sometimes, but try saying the words slowly and making good comparisons.

Vowel symbols, cont'd

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- Don't forget: use exemplars to classify new words.
- Resource: Ladefoged's *A course in phonetics* contains a wonderful chart with several minimal sets of vowel contrasts.
- Exercise: now take all of the symbols you have learned and place them on a two dimensional chart, with tongue advancement on the horizontal plane and tongue height on the vertical plane.

Transcribing suprasegmentals

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- Stress (many conventions, IPA for this class)
 - ▣ Raised line for 'following main stress' and lowered line for 'following secondary stress'
 - ▣ Example: Manitoba [ˌmænɪˈtɔʊbə]
- Lexical tone (many conventions, no standard)
 - ▣ 'Chao' transcription system represents a pitch shape as movement on a 5 point scale, e.g., Mandarin fourth tone is 5-1, *ba* 'father' is a sharp fall in pitch
- Length: two options, double letter or use of ':'

Goals and recommendations

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- Goal for this class: you should be able to provide phonemic transcriptions for words with the 'core sounds', i.e., all sounds introduced up to this point. You should be able to transcribe English words and phrases using these phonemes. You should also be able to give narrow transcription, when given a set of allophonic rules. You will be tested on this in the midterm.
- Tips:
 - ▣ Practice with quizzes, exercises in book
 - ▣ Use a dictionary with IPA representation for pronunciation (and verify it with your own investigations)
 - ▣ Pronouncing dictionaries.

Review: sound charts

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- As a review of the systems of consonant and vowel contrasts, take all of the core consonants, and core vowels, and chart them using the phonetic factors we've established thus far.

English consonants

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- Observation: there are many important phonetic structures that are not captured by the 'core structures', i.e., our phonemic transcription of English
- Objective:
 - ▣ Characterize more detailed phonetic structures, and tools for describing them
 - ▣ Enumerate rules of English allophones for consonants

Stops

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- Observation: the realization of a stop sound depends on its context.

#__ (vls)	#__ (vd)	a#__	s__	V__# (vls)	V__# (vd)
pie	bye	a buy	spy	nap	nab
tie	dye	a dye	sty	mat	mad
kye	guy	a guy	sky	knack	nag

- Task: pronounce the words in the comparisons above and make phonetic observations

Stops: 'aspiration'

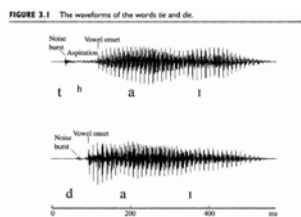
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- Observation: /p t k/ and /b d g/ differ word initially not primarily in voicing, but *aspiration*, a period of voicelessness after the stop articulation and before the beginning of the vowel.
 - Example: *pie* vs. *buy*
 - Transcription: in narrow transcription, aspirated Cs have a [h], so *pie* = [p^haɪ].
- Observation: /b d g/ are normally voiced in the middle of a word or phrase when a voiced sound occurs on both sides, e.g., *a boy*.

Stops, timing issues

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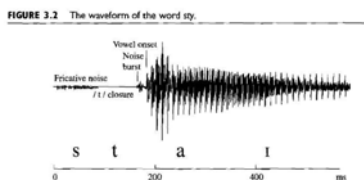
- Voice onset time (VOT): the moment that voicing (usually for vowels) occurs relative to the release of a stop.



Stops, a comparison

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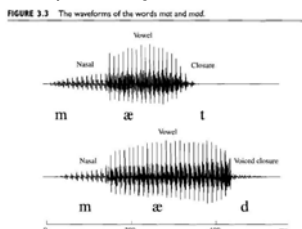
- Observation: stops after voiceless sounds, like /s/, in English are voiceless and unaspirated, e.g., *sty*.
- Question: is /t/ of *sty* more like word-initial /t/ or /d/?



Stops, vowel length as a cue

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- Observation: the contrast between /p t k/ and /b d g/ is not a matter of voicing word-finally, but the length of the preceding vowel.



Stops, unreleased stops

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- Exercise: say the phrase *The cat pushed*.
- Observation: not all stops are released; before another nasal or stop, stops are generally unreleased.
- Transcription: small raised mark [̚], thus, *The cat pushed* is [kʰæf̚ pʰʊʃt̚].
- Diacritics: certain symbols are used in the IPA that mark phonetic structures by combining with an existing symbol.

Stops, glottal stops

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- Observation: stops can be made in the glottis; glottal stops occur in words like *uh-oh* and a negative response to a question with [ʔʌʔʌ]; a glottal stop can sometimes be heard in words that begin with vowels, like *apple*.
- Allophonic rule of /t/: glottal stop is an allophone of /t/ in words like *beaten* and *kitten*. Consider also London Cockney pronunciations of *butter*, *kitty*, *fatter*.
- Allophonic rule of /p t k/: syllable-finally these stops are 'preglottalized', i.e., there is a glottal closure timed slightly before the oral closure.

Stops, nasal and lateral plosion

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- Observation: when followed by a /n/ or /l/, voiced stops are not released in the normal way.
- Exercise: consider *hidden* and *ladle*
- Questions: is there a vowel after the /d/ in *hidden*?
- Nasal plosion: the release of a stop through the nose by lowering the soft palate
- Lateral plosion: the release of a stop laterally by lowering one of the sides of the tongue

Fricatives

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- Observations: some of the allophonic patterns in stops are also found in fricatives
 - Vowel length: vowels before voiced fricatives are longer than those before voiceless fricatives
 - Segment length: voiced fricatives are shorter in duration than their corresponding voiceless fricatives word-finally
 - True voicing only in voicing contexts: voiced fricatives are only truly voiced if they appear between two voiced segments.

Fricatives, a difference

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- Observation: with certain fricatives /s z ʒ/ there is a labial articulation in addition to the primary coronal articulation.
 - Exercise: consider the actions of the lips in *sip*, *ship*, and contrast them with the interdental fricatives in *thin*, *teeth*.
 - Transcription: this kind of secondary labialization is sometimes transcribed with a raised [w], but we will not use this convention in English.

Affricates

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- Review: an affricate is a single phonological unit that is composed of a stop followed by a homorganic fricative.
- Affricates that are phonemes: /tʃ/ and /dʒ/
- Sequences of phonemes that have the phonetic requirements to be affricates: /ts/ and /tθ/
- Discussion: the difference is not phonetic, but a matter of the range of contrasts that are found. /tʃ/ and /dʒ/ can occur word-initially, so we have minimal pairs like *chai* vs. *pie*. This is not possible with /ts/. These kinds of matters are the domain of phonological analysis.

Nasals

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- Observations: nasals, as well as liquids /r l/ can be syllabic when at the end of words and occurring before certain consonants.
- Examples
 - ▣ *sadden* [sædɪŋ], cf. *den* [dɛn]
- Transcription: combining lower line under syllabic consonant.

Nasals, syllable structure

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- Question: how does one predict the occurrence of syllabic nasals, and sonorants generally?
- Assumption: it is a matter of syllable structure; it is the optimal way of organizing obstruent + sonorant combinations in a single syllable. This follows from the principle of sonority sequencing, according to which sonority, or overall salience of a segment, raises from the beginning of a syllable to its peak, and falls from the peak to the end of a syllable.
- Illustration:
 - ▣ One syllable: *tint* [tɪnt.] Nasal + stop, fall in sonority okay
 - ▣ Two syllables: *mitten* [mɪ.ʔn], stop + nasal not a fall, so [mɪtɪn] impossible.

Nasals: the velar nasal

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- Observation: the velar nasal has a number of special properties.
 - No word-initial [ŋ]
 - Not possible as syllabic nasal
 - Always after /ɪ ɛ ʌ æ ə/
- Assumption: this is again, a matter of phonological analysis, not phonetics. It's distribution is restricted, and phonology has a number of tools designed specifically to deal with restrictions like this.

Approximants

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- Approximants
 - Liquids: r l, *rack*, *lack*
 - Glides: w j, *whack*, *yak*
- Distribution: approximants are special in that they can appear after an obstruent word-initially, e.g., *pray*, *flake*, *twin*.
- Observation: approximants that appear after the voiceless stops /p t k/ are voiceless. This is a manifestation of the aspiration that accompanies word-initial stops; the voicelessness is the VOT rather parallel to the singleton initial stop.
- Transcription: diacritic lowered ring is used, e.g., [pɹ̥aɪ]

Approximants: velar /l/

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- Observation: syllable-final /l/ has strong velarization in English.
- Illustration: contrast pronunciation in *leaf* and *feel*. What is the configuration of the tongue? *Leaf*: tongue tip is touching (barely) the alveolar ridge on one or both sides near the upper teeth. With *feel* most speakers have contact between the tip and the center of the alveolar ridge; also the center of the tongue is pulled down and the back is arched upward, as in a back vowel. The arching back of the tongue causes a velarization, a salient feature of the English sound system.
- Transcription: velar /l/ is [ɫ]

Rules of English allophones

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- Exercise: work through the list (on the website, chapter 3) as a review of these topics, plus a few new ones.
- Questions:
 - ▣ Which rule does the comparison *cap* vs. *cab* illustrate?
 - ▣ Why aren't the nasals or liquids syllabic in the words *kiln*, *film*?
 - ▣ Why is there an asymmetric relationship between /l r/ and nasals in terms of their syllabic status? Or: why is /n/ not syllabic in *kiln* but /l/ is in *kenel*?

Consonant allophones, cont'd

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- Questions
 - ▣ Why is the /t/ of *fatty* realized as a tap, but not in *hasty* or *attack*?
 - ▣ In the pronunciation of *most people*, what happened to the word-final /t/? Is the tongue tip gesture still instantiated?
 - ▣ In the pronunciation of *something*, why does a /p/ get inserted?

Practice

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- Exercise: now do transcription practice with narrow phonetic transcription of consonants.

English vowels

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- Objective: investigate in more detail the phonetic structures of vowels, understand some of the variation and the allophonic rules.
- Problems to confront
 - ▣ Vowels differ from consonants in that there are not clear articulatory targets as with consonants; the boundaries between one vowel and another is not best characterized in articulatory terms
 - ▣ Variation: there is a lot of dialect and speaker variation in the phonetics of vowels; this can be a real challenge

Phonetic dictionaries

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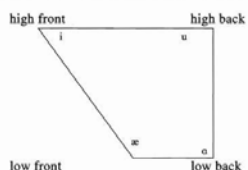
- Resource: phonetic dictionaries, 'pronunciation dictionaries' can be a valuable resource in studying vowel structures
 - ▣ English pronouncing dictionary (16th edition, legacy of Daniel Jones)
 - ▣ A pronouncing dictionary of American English (Kenyon and Knott, \$14 on amazon.com)
- Uses: dialect variation, checking transcription of a sound, studying underlying rule systems
- Warning: there are a lot of online resources claiming to have phonetic transcriptions that are rather weak; use these and the references in *A course in phonetics* as your consumer's guide.

Vowels: continuums, not targets

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Exercises: sustain the vowel in *had* and gradually to the high front vowel in *heed*. Next: [æ] to [ɑ], [ɑ] to [u]. Note vowels you pass through along the way.

FIGURE 4.1 The vowel space.



Auditory qualities

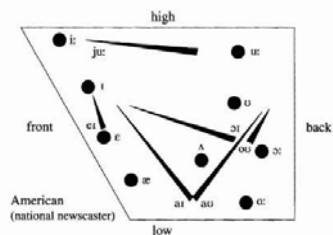
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- Observation: the phonetic factors 'high/low', 'back/front' have an articulatory meaning, but their underlying analysis is not based in articulations. Rather, they are based in auditory qualities that stem from the acoustics of formant structures. Formants are the 'characteristic overtones' in the waveforms of vowels. Vowel charts are two dimensional representations of these formats. The acoustics of formants is discussed in chapter 8 of *A course in phonetics* and more advanced phonetics classes.
 - First format for vertical dimension (less than 500 Hz is high, raises with lower vowels)
 - Second format, or difference between F2 and F1 for front-back distinction

Vowel chart for North American English

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- Monophthongs are solid points, and diphthongs are transitional



Some observations

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- Front vowels [i ɪ ɛ æ] are evenly spaced in the vowel chart; convince yourself by listening to your pronunciations of pairwise comparisons; also dialect variation involves shifts of portions of the entire series (e.g., North England has lower/backer [æ], and adjacent [ɛ] is also slightly lower)
- Back vowels [u ʊ (ɔ) ɑ] also appear to be spaced in a way as to maximize contrasts.

Observations, cont'd

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- Diphthongs: V1 (first vowel structure) is usually longer and more prominent than V2, which is more transitory and difficult to pinpoint in the vowel chart
- In most cases, V1 vowel structure is only observed as part of a diphthong
- Raising diphthongs [aɪ aʊ] V1 is somewhere between [æ] and [ɑ]
 - ▣ Exercise: establish this by finding the vowel in eye using the [æ - ɑ] continuum; also, try to locate the endpoint for [aɪ]; limit it first to [ɛ] and then let it extend naturally

Observations, cont'd

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- Mid-raising [eɪ oʊ]
 - ▣ Exercise: locate V1 for both and try to estimate the trajectory by comparing a sustained portion of V2 with [ɛ] and [ɪ]
- Back-to-front diphthong [ɔɪ]; again, locate V1 and trace the trajectory
- Larger theme: the four basic 'landmarks' in the vowel space provide continuums in the vowel chart. Characterizing vowel structures involves placing sounds on these charts. You have the ability to do that yourself and study the pronunciation of others.

Rhotacization

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- Observation: vowel structures can be characterized by the presence of another auditory property, rhotacization, or 'r-coloring'. The vowel in *her* is rhotacized. Rhotacization can be achieved in different ways, i.e., with a retroflex tongue tip/blade gesture or a bunched tongue back. But as an auditory property, both articulations have an acoustic structure that is heard as the same.
- Dialect differences: *mirror* [mɪrɛr] vs. [mɪrɛ]
 - ▣ North America (norm), Scottish varieties: rhotic
 - ▣ UK around London, New England (US), South US: nonrhotic

Review: dialect differences

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- Range of contrasts
 - [ɑ] vs [ɔ] in *cot*, *caught*, *lost* in California English
 - [ɑ] vs [ɒ] vs [ɔ] in British *cart*, *cot*, *court*
- Different sounds in contrast
 - Texas English: [pɑ]: 'Pa' vs. [pa:] 'pie'
 - Midwestern English: [pɑ]: 'Pa' vs. [paɪ] 'pie'
- Exercise: describe some dialect differences that illustrate differences in the range of vowel contrasts or the different sounds used in a contrast.

Unstressed syllables

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- All vowel phonemes can appear in stressed and unstressed syllables.
- Alternations: in some cases, a vowel in the same morpheme alternates with stress. Predicting when a vowel alternates is in the domain of phonology (save for later).
 - Example: *emph[æ]tic* vs. *emph[ə]sis*
- Central or lax vowels: it is often tough to distinguish among the following set of vowels, /ɪ ɛ ə ʌ/. In many cases, it is the case that more than one vowel is used, i.e., the form is in free variation. The only rule here is to listen carefully, and use exemplars to classify the sounds. Pronouncing dictionaries may also help.
- Note also the central high vowel [ɪ] in *rec[ɪ]tation*.
 - Task: show that this is different from schwa and the high lax vowel.

The tense/lax distinction

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- Tense/lax are labels that refer to two different sets of vowels.
- Lax: ɪ ɛ ʊ ə ʌ
- Tense: i eɪ u ɑ ɔ əʊ aɪ oɪ ou
- Analysis: this distinction is made on both phonetic and phonological grounds. Phonetically, lax vowels are more central in the vowel space and shorter in duration, while tense vowels are longer and more peripheral, i.e., at the extremes of the two dimensional vowel space. Phonologically, there are a host of restrictions on lax vowels (in English).
 - Task: reexamine the corresponding tense/lax vowels on the vowel chart to see the central/peripheral difference.

Tense/lax, cont'd

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- Restrictions: lax vowels generally do not occur in open syllables (cannot end syllables, especially true of monosyllables), and there is no tense/lax contrast in certain environments, namely $___r]_{\sigma}$, $___ŋ]_{\sigma}$, and $___ŋ]_{\sigma}$
 - Task: try to form an imaginary word that violates these restrictions.

Rules of English vowel allophones

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- (1) CV > CVD > CVT (D = voiced C, T = voiceless C)
- (2) Vowels of stressed syllables > vowels of unstressed syllables
- (3) σ > $\sigma\sigma$ > $\sigma\sigma+$
- (4) Reduced vowels may be voiceless after (and before) voiceless stops
- (5) Vowels may be nasalized in syllables closed by a nasal consonant.
- (6) Vowels may be retracted (like a diphthong ending in unrounded [ʊ]) before syllable final [t]

Useful exercises

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- Plot your own vowels on a vowel chart. Do this using the method described here and in chapter 4 of *A course in phonetics*. Use the four peripheral landmark vowels, and place vowel structures on the continuums.
- Transcription practice.

Beyond English

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- Observation: though English illustrates many important phonetic structures, there are many more that are employed in the world's languages
- Additional structures
 - ▣ Different airstream mechanisms
 - ▣ Different uses of the glottis to make sounds
 - ▣ Missing cells in the IPA charts
- Exercises: extend the 'core structures' to 'extended set' (see class notes) to account for more structures

Airstream mechanisms

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- Observation: airflow is achieved by distinct cavities that have different air pressures. Airstream mechanisms can be understood as different ways in which air flows from one cavity to the next in order to equalize air pressure.
- Exercise: provide a schematic diagram of the air pressures of the cavities in the vocal tract for an alveolar oral stop /t/. Discuss the how the release of a stop in words like *top* and *button* achieve equalization of air pressure.

Airstream mechanisms, some types

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- **Pulmonic airstream mechanisms:** the movement of air caused by the respiratory muscles, i.e., the muscles of the chest. (Most consonant and vowels.)
- **Glottalic airstream:** movement of pharynx air by the action of the glottis (ejectives and implosives).
- **Velaric airstream mechanism:** movement of mouth air by action of the tongue (clicks).

Airstreams: using the glottis

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- Observation: because the structures surrounding it can be raised and lowered, the glottis can be used to push or pull air as well.
- Task: draw a schematic diagram of the vocal tract; consider the role of the glottis as a valve that can close together with a complete closure downstream at the alveolar ridge. Next consider the effect of raising and lowering a sealed glottis. What happens if the glottis is raised? What if it's lowered?

Ejectives

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- Ejectives: sounds produced with a glottalic airstream mechanism where the glottis is raised, causing a pushing of air out the mouth.
- Convention: ejectives are written with an apostrophe after the stop consonant, e.g., [k'] for a velar ejective. There isn't a voiceless/voiced distinction in ejectives, so they are always written as voiceless.
- Explore: Hausa and Lakhota examples on the textbook CD
- Exercise
 - Many speakers of English produce preglottalized stops syllable finally, e.g., *bike*
 - Produce a word like [aʔa]
 - Now superimposed the glottal gesture over the /k/ gesture: [ak'a]

Implosives

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- Egressive vs. ingressive: airstream mechanisms in which air flows out of the mouth are egressive, when air flows out of the mouth, it is ingressive
- Implosives: sounds produced with a glottalic airstream mechanism where the glottis is lowered, pulling air into the mouth (=ingressive)
 - Facts: the downward-moving larynx is generally not completely closed, so air from the lungs may pass through and cause vocal cord vibration. Most implosives are therefore voiced.
- Convention: see the nonpulmonic chart of the IPA to see the conventions for implosives. Basically, there is a rightward hook on the top of a the stem for the corresponding voiced stop, e.g., [ɓ]

Implosive, cont'd

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- Exercises
- Try to imitate the 'King of the Hill' character's pronunciation of *boy*; often this kind of Southern white speech is an implosive, especially in emphatic forms.
- Discussion: ingressive glottalic airstream is a bit of a simplification, as the cavity between the oral closure and the larynx is not appreciably lowered, and air does not rush in or out of the mouth.
- Explore: Sindhi on the CD

Clicks: using the tongue

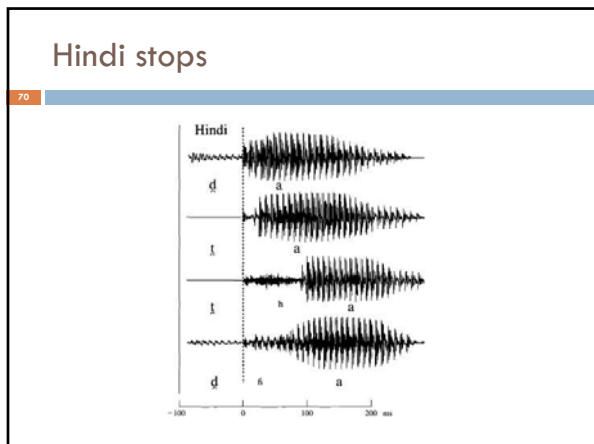
65

- Observation: the movements of the tongue can actually cause ingressive airstreams
- Examples
 - ▣ Expressions of disapproval, *tut-tut*, *tsk-tsk*
 - ▣ Sound used for encouraging animals
- Task: make an aerodynamic model of a dental click with the following actions: (i) closure with back of tongue and velum and tongue tip and back of upper teeth, (ii) lower the body of the tongue, (iii) tongue tip lowered

Clicks, cont'd

66

- Different types of clicks:
 - ▣ Dental click: [k]
 - ▣ Dental click with lateral air suction: [kll]
 - ▣ Click with tongue tip and back of alveolar ridge: [k!]
 - ▣ Bilabial clicks 'straight-lips kiss': [ʘ]
 - ▣ Nasalized click: [ɽ̃] (sometimes with tie bar over the two)
 - ▣ Note: because these clicks occur in conjunction with a velic closure, we include a [k] before the click.
- Explore: Zulu and Xhosa on CD
- Exercise: produce [k | a]



- ### Beyond English: new gestures
- 71
- Observation: while English exhibits many important place-manner combinations, many more are found in the world's languages.
 - Objective: investigate new phonetic structures by filling out the consonant and vowel charts
 - 'Extended core' = just those sounds discussed below and listed in the final slides below. Some of the sounds discussed in the textbook are excluded to focus our attention on rather common sounds.

- ### Bilabials
- 72
- Bilabials: two lips as active articulators
 - Fricatives: [ɸ β]
 - Examples:
 - Spanish: allophone of /b/
 - Ewe: bilabial fricatives are distinct phonemes (explore Ewe fricatives on the phonetics CD)

Labio-dentals

73

- Articulation: lower lip and upper teeth
- Nasal: [ŋ]
 - Example: assimilated nasal in words like *symphony*
- Affricates: release of [p] can be into an [f], hence a labio-dental affricate
 - Example: German [pf], e.g., *Pfanna* [pfanə]

Dentals

74

- Articulation: tongue tip, between teeth or just behind upper teeth
- Observation: many alveolar sounds have dental allophones (resulting from assimilation)
- Examples
 - [t̪] in *eight*
 - [n̪] in *tenth*
 - [l̪] in *wealth*
- Explore: dentals in Malayalam

Retroflex

75

- Articulation: curling the tip of the tongue up and back so that the underside touches or approaches the back part of the alveolar ridge
- Examples
 - Hindi accented English
 - Important sounds: [ʈ ɖ ʂ ʐ]
 - Explore: Malayalam on phonetics CD

Palato-alveolars, alveolo-palatals

76

- Palato-alveolars: tongue blade and back of alveolar ridge
- Alveolo-palatals: similar to palato-alveolars, but with considerable raising of the front of the tongue
- Examples
 - ▣ Alveolo-palatal fricatives [ʃ ʒ] in Chinese and Polish: explore on phonetics CD
 - ▣ Korean alveolo-palatal affricates

Palatals

77

- Articulation: front of the tongue approaching the hard palate
- Fricatives: [ç ʝ]
- Examples
 - ▣ [ç] in English words like *hue*
 - ▣ German [ç] in words like *ich* 'I', *nicht* 'not'
- Nasal: [ɲ] as in Spanish *niño* 'child'
- Exercise: make sure you can distinguish all these nasals: [ɲ ɳ ɲ̃ ɳ̃]

Velars

78

- Articulation: back of the tongue and soft palate
- Fricatives: [x χ]
- Examples:
 - ▣ German [x], as in 'Bach' [bax]
 - ▣ Spanish [x χ] : in *ojo* [OXO] 'eye' and *lago* [laχO] 'lake'
 - ▣ Explore Lakhota on phonetics CD

Uvulars

79

- Articulation: raising the back of the tongue toward the uvula.
- Fricatives [χ ʁ]
 - ▣ French: word-initial voiced fricative [ʁ], *rouge, rue, rose*, cf. voiceless allophone [χ] after voiceless stops, e.g., *lettre*

Some additional gestures

80

- Prenasalized stops: during an oral closure, soft palate is lowered before release of oral closure
 - ▣ Example: [nd] in many African languages, e.g., *ndege* [ndege] 'bird, airplane' in Swahili
- Taps and trills: a single contraction of the muscles so that one articulator is thrown against another (tap), or multiple contractions (trill)
 - ▣ Example: Spanish *pero* 'but' vs. *perro* 'dog'

More gestures, cont'd

81

- Voiceless lateral fricative [ɬ]: same articulation as *led*, without vocal fold vibration
- Voiced lateral fricative [ɮ]: lateral articulation, with vocal fold vibration and tongue closer to the teeth than with the approximant
 - ▣ Example: explore Zulu in phonetics CD
- Palatal lateral approximant [ʎ]: as in Italian *figlio* [fiʎʎo] 'son'

Vowels, rounded/unrounded

82

- Observation: many languages only have rounded back vowels and unrounded front vowels
- Examples of opposite rounded settings:
 - Back high unrounded vowel [ʊ]
 - ▣ Task: produce normal [u], remove rounding
 - ▣ Example: Korean, as demonstrated in class
 - Front rounded vowels [y ʏ ø œ]
 - ▣ Task: produce normal [i], then introduce rounding: [y]
 - ▣ Examples: front rounded vowels are exemplified in the French demonstration in class.

Core sounds, English consonants

83

- English consonants
 - ▣ Stops: p b, t d, k g, ʔ
 - ▣ Fricatives: f v, θ ð, s z, ʃ ʒ, h
 - ▣ Affricates: tʃ dʒ
 - ▣ Nasals: m, n, ŋ
 - ▣ Approximants: l r w j
- Exercise: plot these sounds in a consonant chart.

Core sounds, English vowels

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- Monophthongs
 - ▣ Front vowels: i ɪ e æ
 - ▣ Back vowels: u ʊ ɔ ɑ
 - ▣ Central vowels: ʌ ɜ ɞ
- Diphthongs:
 - ▣ Diphthongs with [ɪ]: eɪ aɪ ɔɪ
 - ▣ Diphthongs with [ʊ]: aʊ oʊ
 - ▣ 'Diphthongs' ending in [r]: ɪr eɪr aɪr
- Exercise: plot in a vowel chart

Extended core sounds

85

- Airstream mechanisms: ejectives, implosives, clicks
- States of glottis: murmur, creaky voice, tense voice
- New gestures: prenasalized stops, taps, trills
- All consonant allophones in English
- Back unrounded high vowel, as in Korean
- Front rounded vowels, as in French

Extended core, cont'd

86

- New place articulations
 - Laterals: [ʎ ʝ ʎ]
 - Bilabials: [ɸ β]
 - Labio-dentals: [ɱ] [ɸ]
 - Dentals: [t̪ n̪ l̪] (with dental diacritic)
 - Retroflex: [ɖ ɟ ɳ]
 - Alveolo-palatals [ɕ ʑ]
 - Palatals: [ç ʝ ʎ]
 - Velars: [x ɣ]
 - Uvulars: [χ ʁ]
- Exercise: superimpose these sounds on core consonant chart

Review exercises

87

- Make charts, like exercises in previous slides
- Chart the sounds of individual languages (e.g., Korean, French, other languages given in previous exercises)
- Make midsagittal profiles, show sequences too
- Given symbol, provide phonetic factors
- In *A course in phonetics*: p. 79 D, p. 102 H, p. 152-54, A, B, D.
